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TEST 1 — 100% OUTDOOR AIR HANDLING UNIT BASIC SYSTEM — DESIGN

Choose the correct answer (from the choices in bold) for each of the following hvac situations, referring to the schematic diagram on this page.

1 On-Off control, in the "off" position:

Outdoor damper D-1 is closed, face and bypass damper (D-2, F-1, V-1) is in the "full face" position, hot water/steam heat valve is open, chilled water/direct expansion cooling valve is closed and fan motor is off.

2 On-Off control, in the "on" position:

Outdoor damper D-1 is open and fan motor is (off, on).

3 Maximum cooling:

Bypass damper D-2 is in the "full face" position, heating valve is closed, cooling valve is open 100% based on discharge air transmitter TT-1 signaling maximum (air, cooling, heating) to maintain setpoint of 55 F.

4 Minimum cooling:

Bypass damper D-2 is in the "full face" position, heating valve is (modulating, full closed, full open), cooling valve modulates toward closing based on discharge air temperature transmitter TT-1 signaling minimum cooling to maintain set-point of 55 F.

5 Free cooling:

Bypass damper D-2 is in the "full face" position, heating valve is closed, cooling valve is (modulating, full closed, full open) and discharge air temperature transmitter TT-1 signal is satisfied based on cool outdoor air maintained at setpoint of 55 F.

6 Minimum heating:

Bypass damper D-2 is in the "full face" position, heating valve (modulates, is 100%, 0%) open based on discharge air temperature transmitter TT-1 signaling minimum heating to maintain setpoint of 55 F, and cooling valve is closed.

7 Maximum heating:

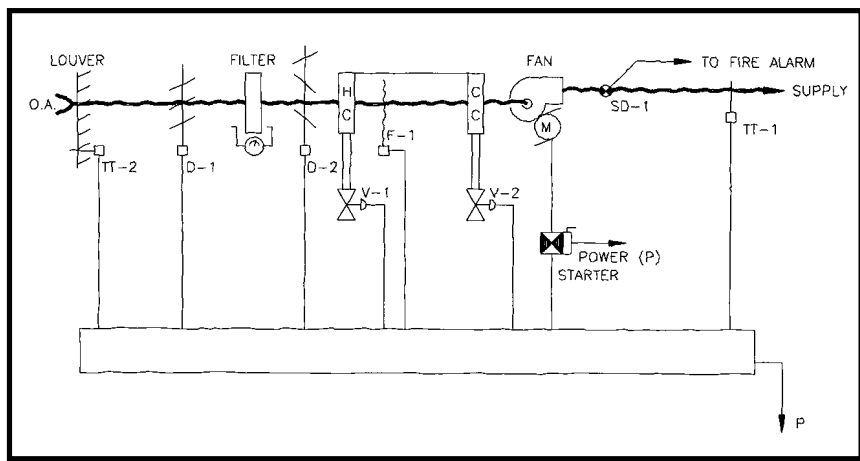
When the outdoor air temperature drops below 38 F based on temperature transmitter TT-2, heating valve shall open 100% and (outdoor air, bypass, zone) damper D-2 shall modulate "bypass" based on discharge air temperature transmitter TT-1 signaling maximum heating to maintain setpoint of 55 F, and cooling valve is (modulating, full closed, full open).

8 Alarms controls:

Freeze-stat F-1, set at 38 F shall shut down fan motor, and system components will go to their "fail safe" positions, which are: outdoor damper D-1 is closed, face and bypass damper D-2 is in the "full face" position, heating valve is (modulating, full closed, full open), cooling valve is closed and fan motor is off. Manual reset of system will be required to restart the system.

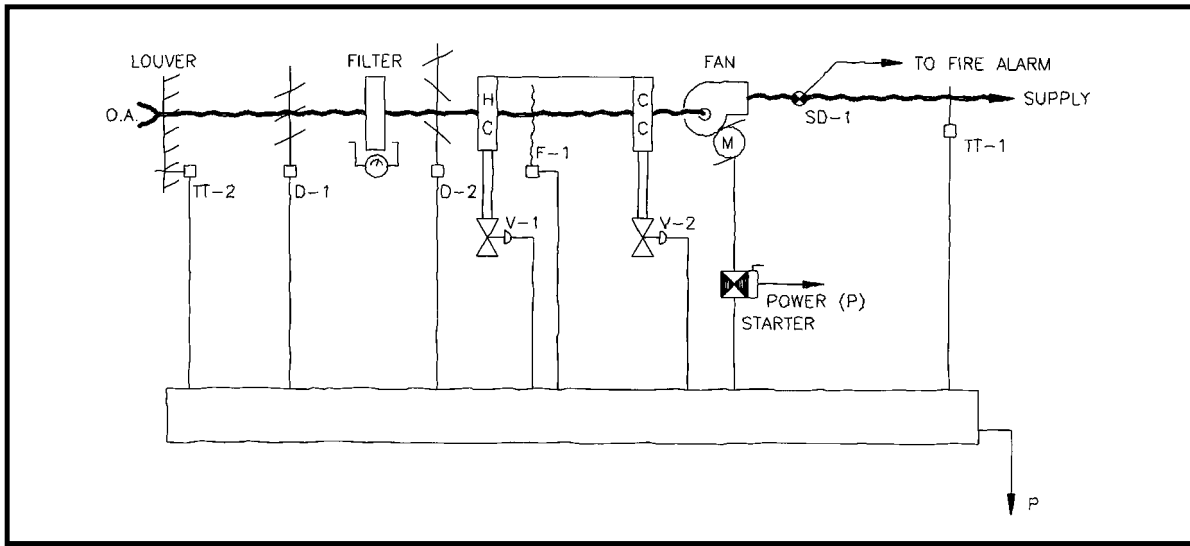
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Duct smoke-detector shall shut down fan motor, signal an alarm condition to the fire alarm system and system components will go to their "fail safe" positions which are: outdoor damper D-1 is (modulating, full closed, full open), face and bypass damper D-2 is in the "full face" position, heating valve is open, cooling valve is closed, and fan motor is off. Manual reset of system will be required to restart the system.



ANSWERS FOR BASIC SYSTEM — COMMISSIONING: 1 a) closes; 1 d) closes; 2 a) opens; 3 a) opens; 3 c) modulate; 4 b) modulate; 5 a) open; 5 c) modulates; 6 c) opens; 7 a) starts. (If you have any questions regarding the Basic System — Commissioning test, fax your concerns, questions, and/or comments to: Rebecca Ellis, P.E., 612-546-0494.)

TEST 2 — 100% OUTDOOR AIR HANDLING UNIT BASIC SYSTEM – COMMISSIONING



Choose the correct answer (from the choices in **bold**) for each of the following hvac situations, referring to the schematic diagram on this page.

- 1** Turn fan **OFF** and verify that:
 - a) Outside air damper D-1 (**closes, opens, modulates**).
 - b) Face and bypass dampers D-2 open to full face position.
 - c) Heating valve V-1 closes.
 - d) Cooling valve V-2 (**closes, opens, modulates**).
- 2** Turn fan **ON** and verify that:
 - a) Outside air damper (**closes, opens**).
- 3** Set discharge air temperature (TT-1) setpoint to 5°F higher than the current outside air temperature reading (TT-2) and hold ice on temperature transmitter TT-2. Verify that:
 - a) Heating valve V-1 (**closes, opens, modulates**).
 - b) Cooling valve V-2 closes.
 - c) Face and bypass dampers D-2 (**close, open, modulate**) to maintain discharge air temperature setpoint.
- 4** Remove ice from TT-2. Assuming outside air temperature is greater than 38°F, verify that:
 - a) Face and bypass dampers D-2 open to full face position.
 - b) Heating valve V-1 (**closes, opens, modulates**) to achieve setpoint discharge air temperature.
 - c) Cooling valve V-2 closes.
- 5** Reset discharge air temperature setpoint to 5°F lower than current outside temperature reading (TT-2). Verify that:
 - a) Face and bypass dampers D-2 (**close, open, modulate**) to full face position.
 - b) Heating valve V-1 closes.
 - c) Cooling valve V-2 (**closes, opens, modulates**) to achieve setpoint discharge air temperature.
- 6** Hold ice on a six-inch section of freeze-stat F-1 and verify that:
 - a) Supply fan stops.
 - b) Outside air damper D-1 closes.
 - c) Heating valve V-1 (**closes, opens, modulates**).
 - d) Cooling valve V-2 closes.
- 7** Manually reset freeze-stat F-1 and return discharge air temperature TT-1 setpoint to original value. Verify that:
 - a) Fan (**stops/starts**).
 - b) Outside air damper D-1 opens.
 - c) Heating valve V-1 modulates in sequence with V-2 to maintain discharge temperature setpoint.
 - d) Cooling valve V-2 modulates in sequence with V-1 to maintain discharge temperature setpoint.